CLAIMS

What is claimed is:

1. A long chain crosslinked elastomeric composition of matter comprising:

100 parts by weight of a rubber selected from the group consisting of polybutadiene, styrene-butadiene rubber, synthetic *cis*-1,4-polyisoprene, synthetic polyisoprene, *cis*-polybutadiene, butadiene-isoprene rubber, styrene-isoprene rubber, styrene-isoprene-butadiene rubber, butyl rubber, neoprene, acrylonitrile-butadiene rubber, natural rubber, EPDM, terminal and backbone functionalized derivatives thereof, and mixtures thereof;

from about 1 to about 15 parts by weight of a difunctional crosslinking agent, per 100 parts by weight of the rubber, having the structure $Y_m(SRS)_nY_m$ where Y is selected from the group consisting of H, SR' and SiR'_3; where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR"; where R' is selected from the group consisting of branched and linear C1 to C10 alkyl, C6 to C10 aryl, C7 to C10 alkyaryl and C4 to C10 cycloalkyl groups; where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups and R" can be the same or different; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof; where m is 0 or 1 and n is 1 to about 100;

from 0 to 5 parts by weight of sulfur; and

from about 0.2 to about 10 parts by weight of at least one accelerator.

2. A long chain crosslinked elastomeric composition of matter, as set forth in claim 1, wherein said difunctional agent is a dimercaptan having the general formula

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where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR" where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups; where X is selected from the group consisting of O,

S, NH, NR' and mixtures thereof and where R' is selected from the group consisting of branched and linear C1 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups.

3. A long chain crosslinked elastomeric composition of matter, as set forth in claim 2, wherein said dimercaptan has the general formula

$$H(SCH_2CH_2OCH_2CH_2S)_nH$$

where n is 2 to 60.

4. A long chain crosslinked elastomeric composition of matter, as set forth in claim 1, wherein said long chain difunctional crosslinking agent has a molecular weight of about 100 to about 10,000 g/mol.

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5. A long chain crosslinked elastomeric composition of matter, as set forth in claim 1, wherein said accelerators are selected from the group consisting of amines, guanidines, thioureas, thiols, thiurams, sulfonamides, dithiocarbamates and xanthates.

6. A method for making a long chain crosslinked elastomeric composition of matter having long chain polymer backbones and long chain crosslinks, comprising:

incorporating long chains of a difunctional crosslinking agent into a vulcanizable elastomer composition comprising 100 parts by weight of a rubber selected from the group consisting of polybutadiene, styrene-butadiene rubber, synthetic *cis*-1,4-polyisoprene, synthetic polyisoprene, *cis*-polybutadiene, butadiene-isoprene rubber, styrene-isoprene rubber, styrene-isoprene-butadiene rubber, butyl rubber, neoprene, acrylonitrile-butadiene rubber, natural rubber, EPDM, terminal and backbone functionalized derivatives thereof, and mixtures thereof;

from about 1 to about 15 parts by weight of a difunctional crosslinking agent, per 100 parts by weight of the rubber, having the structure $Y_m(SRS)_nY_m$ where Y is selected from the group consisting of H, SR' and SiR'_3; where R is

selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR"; where R' is selected from the group consisting of branched and linear C1 to C10 alkyl, C6 to C10 aryl, C7 to C10 alkyaryl and C4 to C10 cycloalkyl groups; where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups and R" can be the same or different; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof; where m is 0 or 1 and n is 1 to about 100;

from 0 to 5 parts by weight of sulfur; and

from about 0.2 to about 10 parts by weight of at least one accelerator; and

vulcanizing said elastomer composition.

7. A method, as set forth in claim 6, wherein said difunctional agent is a dimercaptan having the general formula

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where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR" where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof and where R' is selected from the group consisting of branched and linear C1 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups.

8. A method, as set forth in claim 7, wherein said dimercaptan has the general formula

$$H(SCH_2CH_2OCH_2CH_2S)_nH$$

where n is 2 to 60.

9. A method, as set forth in claim 6, wherein said accelerators are selected from the group consisting of amines, guanidines, thioureas, thiols, thiurams,

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sulfonamides, dithiocarbamates and xanthates.

10. A rubber article manufactured from a long chain crosslinked elastomeric composition of matter comprising:

100 parts by weight of a rubber selected from the group consisting of polybutadiene, styrene-butadiene rubber, synthetic *cis*-1,4-polyisoprene, synthetic polyisoprene, *cis*-polybutadiene, butadiene-isoprene rubber, styrene-isoprene rubber, styrene-isoprene-butadiene rubber, butyl rubber, neoprene, acrylonitrile-butadiene rubber, natural rubber, EPDM, terminal and backbone functionalized derivatives thereof, and mixtures thereof;

from about 1 to about 15 parts by weight of a difunctional crosslinking agent, per 100 parts by weight of the rubber, having the structure $Y_m(SRS)_nY_m$ where Y is selected from the group consisting of H, SR' and SiR'_3; where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR"; where R' is selected from the group consisting of branched and linear C1 to C10 alkyl, C6 to C10 aryl, C7 to C10 alkyaryl and C4 to C10 cycloalkyl groups; where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups and R" can be the same or different; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof; where m is 0 or 1 and n is 1 to about 100;

from 0 to 5 parts by weight of sulfur; and

from about 0.2 to about 10 parts by weight of at least one accelerator.

11. A rubber article, as set forth in claim 11, wherein said difunctional agent is a dimercaptan having the general formula

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where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR" where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4

to C10 cycloalkylene groups; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof and where R' is selected from the group consisting of branched and linear C1 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups.

12. A rubber article, as set forth in claim 12, wherein said dimercaptan has the general formula

$$H(SCH_2CH_2OCH_2CH_2S)_nH$$

where n is 2 to 60.

13. A rubber article, as set forth in claim 11, wherein said long chain difunctional crosslinking agent has a molecular weight of about 100 to about 10,000 g/mol.

14. A rubber article, as set forth in claim 11, wherein said accelerators are selected from the group consisting of amines, guanidines, thioureas, thiols, thiurams, sulfonamides, dithiocarbamates and xanthates.

15. A pneumatic tire for use on wheeled vehicles having a component manufactured from a long chain crosslinked elastomeric composition of matter comprising:

100 parts by weight of a rubber selected from the group consisting of polybutadiene, styrene-butadiene rubber, synthetic *cis*-1,4-polyisoprene, synthetic polyisoprene, *cis*-polybutadiene, butadiene-isoprene rubber, styrene-isoprene rubber, styrene-isoprene-butadiene rubber, butyl rubber, neoprene, acrylonitrile-butadiene rubber, natural rubber, EPDM, terminal and backbone functionalized derivatives thereof, and mixtures thereof;

from about 1 to about 15 parts by weight of a difunctional crosslinking agent, per 100 parts by weight of the rubber, having the structure $Y_m(SRS)_nY_m$ where Y is selected from the group consisting of H, SR' and SiR'_3; where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR"; where R' is selected from the group consisting of branched and linear C1 to C10 alkyl, C6 to C10 aryl, C7 to C10 alkyaryl and C4 to C10

cycloalkyl groups; where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups and R" can be the same or different; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof; where m is 0 or 1 and n is 1 to about 100;

from 0 to 5 parts by weight of sulfur; and

from about 0.2 to about 10 parts by weight of at least one accelerator.

16. A pneumatic tire, as set forth in claim 16, wherein said difunctional agent is a dimercaptan having the general formula

HSRSH

where R is selected from the group consisting of branched and linear C2 to C20 alkylene, C6 to C20 arylene, C7 to C20 alkyarylene and C4 to C20 cycloalkylene groups and R"XR" where R" is selected from the group consisting of branched and linear C2 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups; where X is selected from the group consisting of O, S, NH, NR' and mixtures thereof and where R' is selected from the group consisting of branched and linear C1 to C10 alkylene, C6 to C10 arylene, C7 to C10 alkyarylene and C4 to C10 cycloalkylene groups.

17. A pneumatic tire, as set forth in claim 17, wherein said dimercaptan has the general formula

$$H(SCH_2CH_2OCH_2CH_2S)_nH$$

where n is 2 to 60.

18. A pneumatic tire, as set forth in claim 16, wherein said long chain difunctional crosslinking agent has a molecular weight of about 100 to about 10,000 g/mol.

19. A pneumatic tire, as set forth in claim 16, wherein said accelerators are selected from the group consisting of amines, guanidines, thioureas, thiols, thiurams, sulfonamides, dithiocarbamates and xanthates.

20. A pneumatic tire for use on wheeled vehicles having a component manufactured from a long chain crosslinked elastomeric composition of matter comprising:

100 parts by weight of a rubber selected from the group consisting of polybutadiene, styrene-butadiene rubber, synthetic *cis*-1,4-polyisoprene, synthetic polyisoprene, *cis*-polybutadiene, butadiene-isoprene rubber, styrene-isoprene rubber, styrene-isoprene-butadiene rubber, butyl rubber, neoprene, acrylonitrile-butadiene rubber, natural rubber, EPDM, terminal and backbone functionalized derivatives thereof, and mixtures thereof;

from about 1 to about 15 parts by weight of a dimercaptan, per 100 parts by weight of the rubber, having the general formula

$$H(SCH_2CH_2OCH_2CH_2S)_nH$$

where n is 2 to 60;

from 0 to 5 parts by weight of sulfur; and

from about 0.2 to about 10 parts by weight of at least one accelerator.

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